Quantum Chemica compressor monitor

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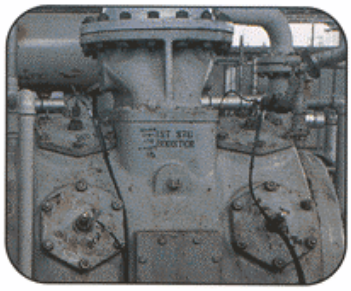

Reciprocating compressor showing RTD pickups mounted into the valve covers.

Quantum Chemical's Morris plant is located fifty miles south of Chicago, Illinois. The Morris plant is a large petrochemical complex that includes a large linear low density polyethylene (LLDPE), a polypropylene, a low density polyethylene (LDPE) and an ethylene unit.

The plant has used Bently Nevada monitoring systems to continuously monitor its turbomachinery since the early 1970's. The result has been reduced maintenance costs and increased onstream time.

Background

In 1993, a Bently Nevada 3300/80 Rod Drop Monitoring System was installed on a small, two-stage vent gas reciprocating compressor. For several years prior to 1993, the compressor had a history of rider band ring failures and piston damage. When damaged, the piston needed to be replaced. After this new system was installed, the plant correctly predicted and trended rider band wear on these pistons several times during a two year period. Instead of changing both the rings and the piston during an unplanned shutdown, the Rod Drop Monitoring System allowed us to trend the rider band wear, to schedule a shutdown and to only change the rider band rings. This saved the cost of the piston, the labor to change it and reduced compressor downtime.

In 1995, we decided to install Rod Drop Monitors on four large polyethylene reciprocating compressors, based on the successful prediction and trending of rider band wear on our two-stage vent gas reciprocating compressor. We also decided to monitor valve temperature and both crankcase and crosshead vibration on these machines. We wanted to improve our ability to correctly predict valve failures and rider band wear and to monitor crankcase and crosshead vibration. The crankcase and crosshead vibration monitoring system would also have compressor shutdown capabilities.

We also specified that the valve temperature, rod drop and crankcase and crosshead continuous monitors should interface to our Bently Nevada Transient Data Manager® 2

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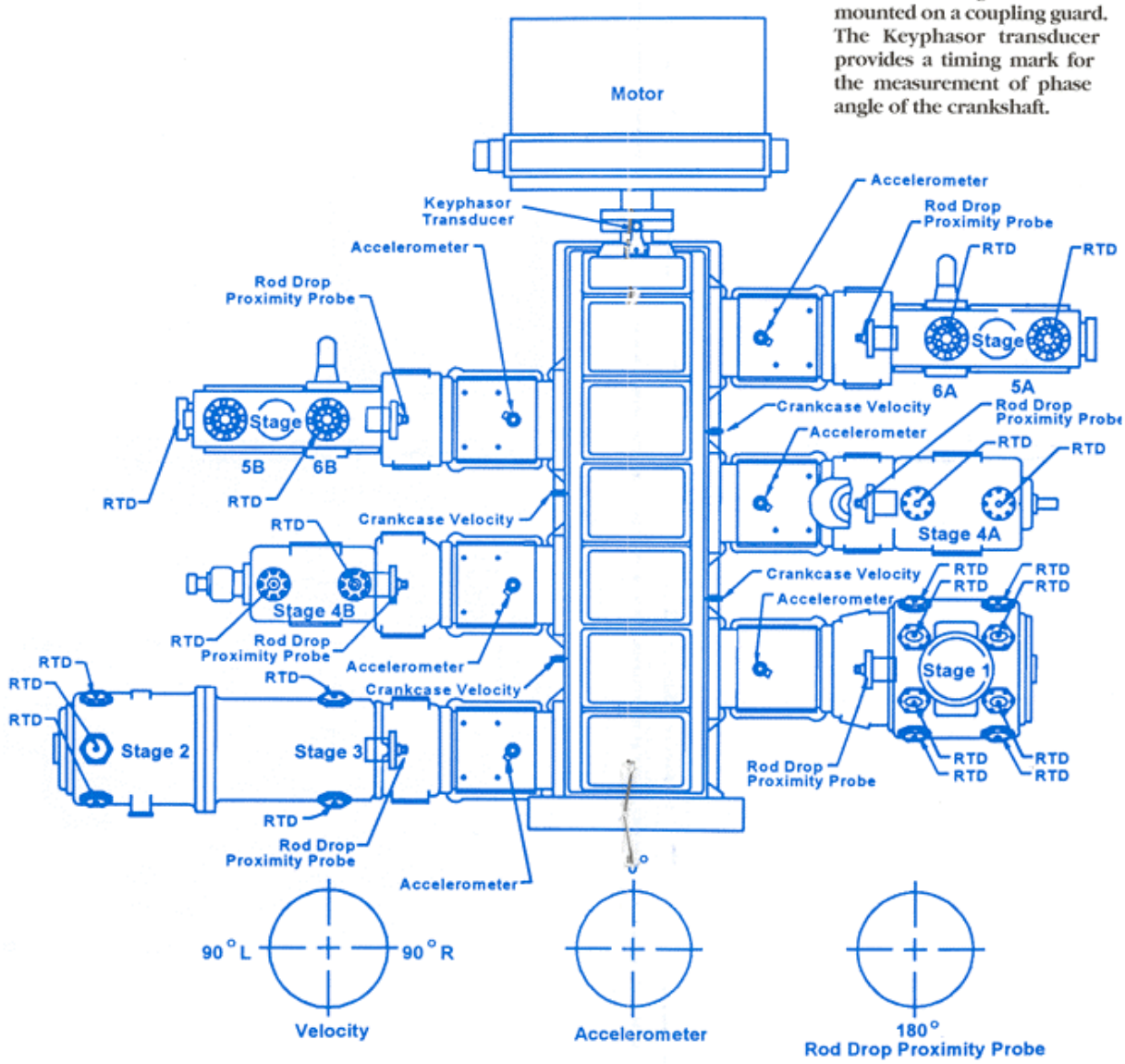
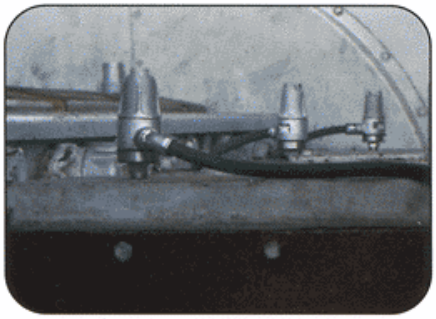
Keyphasor® transducer in a 21000 housing which is mounted on a coupling guard. The Keyphasor transducer provides a timing mark for the measurement of phase angle of the crankshaft.

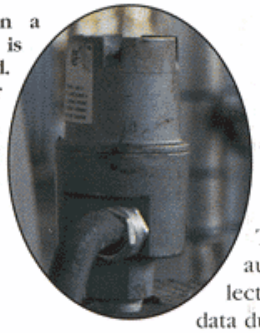


Machine train diagram, showing transducer locations.

uses reciprocating to improve reliability



Reciprocating compressor, showing three case-mounted accelerometors.



Keyphasor® transducer in a 21000 housing which is mounted on a coupling guard. The Keyphasor transducer provides a timing mark for the measurement of phase angle of the crankshaft.

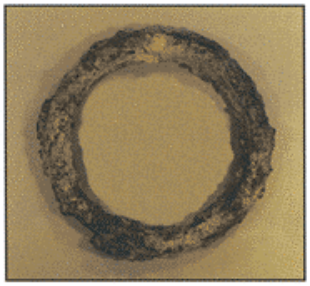
(TDM2) computer system. The TDM2 System automatically collects and processes data during both steady state and transient (startup and shutdown) machine operation. This would enable us to trend and analyze these readings, just as we have analyzed our turbomachinery condition for years. TDM2 plots can be imported into other applications for easy report writing. Quantum incorporates TDM2 plots in their own reports (see Figures 1, 2 and 3).

In July and August 1995, the Reciprocating Compressor Monitoring System was installed on two polyethylene compressors and was interfaced to our TDM2 System by Bently Nevada's Design and Installation Services Department. The system monitored valve temperature on 48 valves, rider band wear using proximity probes on 6 piston rods, crankcase velocity with 4 Bently Nevada Velomitor® piezo-velocity sensors per compressor and crosshead acceleration with 6 accelerometers (see machine train diagram for transducer locations). In 1996, we will install Bently Nevada Reciprocating Compressor Monitoring Systems on the other two polyethylene compressors.

Case history #1

Trend plots (Figures 1 and 2) indicated an increase in temperature on both the suction and discharge valves on the fourth stage cylinder of one of the large ethylene reciprocating compressors. The temperature had increased from 60° to 113°C (140° to 235°F) over a 24 hour period on the discharge valve, and from 38° to

Broken valve disk



Plugged suction valve disk

102°C (100° to 215° F) on the suction valves. These valve temperature trends, which indicated valve problems on the fourth stage, were trended on the TDM2 System. We were then able to plan the shutdown and to replace the valves during a scheduled outage. The used valves revealed that the discharge valve disc had broken into three pieces and the suction valve was almost completely plugged. (See photos of broken valve disc and plugged suction valve.)

Before installing the Bently Nevada Reciprocating Compressor Monitoring System, the plant had a difficult time determining which of the valves on these compressors was failing. Often we would change several or all of the valves on the cylinder, as we couldn't tell which valve had failed. The successful analysis of these valve failures has reduced both maintenance costs and production downtime.

Case history #2

Figure 3 is a trend plot of the rod drop on the first stage of the same compressor. Shortly after the compressor startup, the TDM2 System indicated a rod drop alarm on this cylinder. The trend plot indicated a large amount of rod movement. The compressor was shut down during a scheduled outage. We found that one of the three packing hold down studs had backed out, and the packing had come loose. Without the Rod Drop Monitoring System, we would not have known about this problem. Early detection of the loose packing prevented the entire packing gland from coming loose in the crosshead area. This prevented a long-term outage that could have resulted in extended downtime and high maintenance repair costs.

Conclusion

The Bently Nevada 3300/80 Rod Drop Monitoring System has helped our plant improve onstream time and quality, while reducing maintenance costs. ■

Photos courtesy of Quantum Chemical

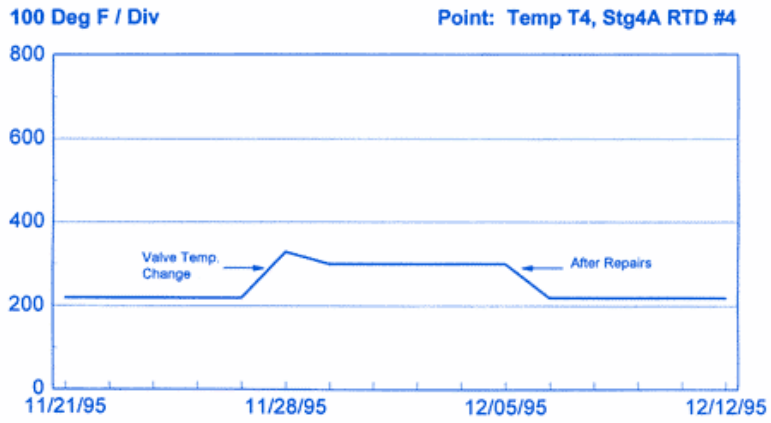


Figure 1
Trend plot of discharge valve temperature

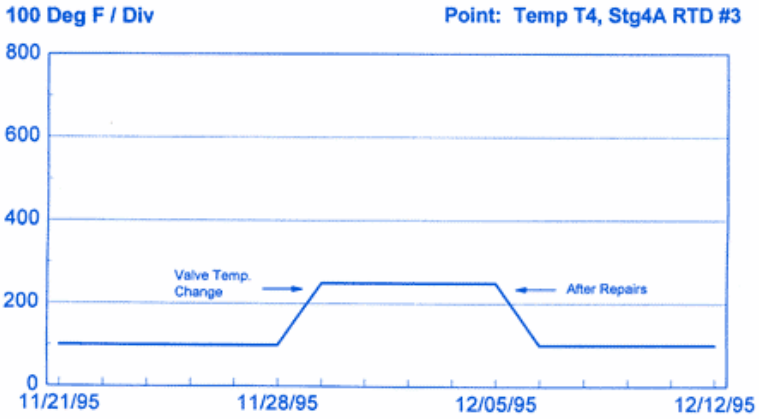


Figure 2
Trend plot of suction valve temperature

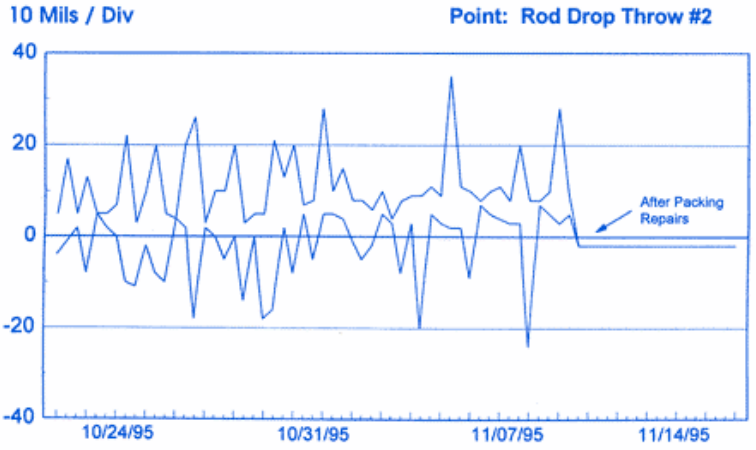


Figure 3
Trend plot showing rod movement on the compressor